

should be met within 5 years of licensing or other period subject to reasonable projection. No loading requirement should apply for smaller bandwidth systems.

Loading requirements in summary:

SYSTEM TYPE	CRITERIA
Analog, <10 MHz BW	No loading criteria
Analog, ≥10 MHz BW	Minimum number of voice channels
Analog, video only	No loading criteria

Analog radios must meet the following loading requirements:

Channel Bandwidth	Minimum loading within 5 years of licensing (voice channels)*			
	4 GHz	6 GHz (5925 - 6425)	6 GHz (6525-6875)	11 GHz
Less than 10 MHz	n/a	none	none	none
10 MHz	n/a	300	300	300
20 MHz	900	600	n/a	600
30 MHz	n/a	900	n/a	900
40 MHz	n/a	n/a	n/a	900

*Analog video systems are exempt from these requirements.

FREQUENCIES

PROPOSED RULE:

Section 101.____ FREQUENCIES.

[Merge Sections 21.701 and 94.65, changing only footnote 1 for 10 GHz DTS channels as set forth below]:

1 - All frequencies at 10565 - 10615 MHz and 10630 - 10680 MHz are also available for DTS stations licensed, in operation, or applied for prior to July 15, 1993.

(h) 10,700 to 11,700 MHz. 40 MHz authorized bandwidth.

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(7) 40 MHz bandwidth channels:

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[Footnotes]

1 Alternate channels. These channels are set aside for narrow bandwidth systems and should be used only if all other channels are blocked.

2 In congested areas where 40 MHz channels block most 30 MHz channels, radios authorized for 30 MHz bandwidths may use the 40 MHz channels. In uncongested areas, 30 MHz channels should be used.

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(1) Transmit and receive frequency pairs listed in this section are recommended, and are not mandatory, unless otherwise noted.

REASON FOR RULE:

TIA proposes merging Sections 21.701 and 94.65 into a single new Section 101.____. However, certain minor changes regarding the 10 and 11 GHz bands are necessary. In addition, TIA proposes that channel pairings be made discretionary rather than mandatory.

10 GHz – The Second Report and Order contains some errors regarding the frequencies available for DTS stations. Some 1.25 MHz channels are erroneously indicated as DTS

frequencies. In addition, some 5 MHz and 2.5 MHz DTS channels are identified incorrectly. These corrections are made. In addition, all Part 21 and Part 94 DTS frequencies are identified in the list of frequencies, but no changes are made to these frequencies.

11 GHz – A footnote is added to the bottom of the list of 11 GHz frequencies. This footnote permits radios authorized for a 30 MHz bandwidth to be used in 40 MHz channels, in congested areas. There currently are two frequency plans in widespread use in the 11 GHz band: the DE Plan and the PJ Plan. In the Second Report and Order, the 40 MHz channels use the DE Plan and the 30 MHz channels use the PJ Plan. This proposed rule allows 30 MHz radios, carrying 2 or 3 DS-3s, to be coordinated in areas using the DE Plan. This procedure will be necessary in a large number of frequency coordinations, since the DE Plan is used in approximately half the metropolitan areas in the U.S.

Channel pairings – New Section 101.____ states that the transmit and receive frequency pairings listed in this section are recommended and are not mandatory. However, standard pairings should be used whenever possible. This is an extremely important point, since many non-standard pairings were used in the past in the 4, 6, and 11 GHz bands. Frequency coordination will be difficult or impossible in congested areas, if non-standard pairings are not allowed.

MODIFICATIONS

PROPOSED RULE:

Section 101.____ **MAJOR MODIFICATION.**

(a) Any pending application may be amended as a matter of right if the application has not been designated for hearing or for comparative evaluation pursuant to [§21.35], provided, however, that the amendments shall comply with the provisions of [§21.29] as appropriate. An MMDS or Multipoint Distribution Service H-channel application tentatively selected by the random selection process may be amended as a matter of right up to 14 days after the date of the public notice announcing the tentative selection, provided, however, that the amendments shall comply with the provisions of [§21.29] as appropriate.

(b) The Commission or the presiding officer may grant requests to amend an application designated for hearing or for comparative evaluation, or tentatively selected by the random selection process, only if a written petition demonstrating good cause is submitted and properly served upon the parties of record, except that MMDS or Multipoint Distribution Service H-channel applications tentatively selected in a random selection process may be amended as a matter of right under paragraph (a) of this section.

(c) The Commission will classify amendments on a case-by-case basis. Whenever previous amendments have been filed, the most recent amendment will be classified by reference to how the information in question stood as of the latest Public Notice issued which concerned the application. An amendment will be deemed to be a major amendment subject to [§21.27] and [§21.31] under any of the following circumstances:

(1) If in the Point-to-Point Microwave Radio Service and Local Television Transmissions Service, the amendment results in a substantial modification of the engineering proposal, such as (but not necessarily limited to):

- (i) A change in, or an addition of, a radio frequency;
- (ii) A change in polarization of the transmitted signal;
- (iii) An increase in the transmitter output power of three (3) dB or more;
- (iv) A change in type of transmitter emission or an increase in emission bandwidth of more than ten (10) percent;
- (v) A change in the geographic coordinates of a station's transmitting antenna of more than ~~five (5) seconds~~ of latitude or longitude, or both;
- (vi) A change of more than one (1) degree in the azimuth of the center of the main lobe of radiation of a point-to-point station's transmitting antenna (including any deflections by repeating devices);
- (vii) Any change which increases the antenna height ~~by ten (10) feet~~ (____ meters) or more; or
- (viii) Any changes or combination of changes, which would cause harmful electrical interference to an authorized facility or result in a mutually exclusive conflict with another pending application.

(2) If in the Multipoint Distribution Service and the Digital Electronic Message Service (excluding User Stations), the amendment results in a substantial modification of the engineering proposal, such as (but not necessarily limited to):

- (i) A change in, or addition of, a radio frequency channel;
- (ii) A change in polarization of the transmitted signal;
- (iii) A change in type of transmitter emission or an increase in emission bandwidth of more than ten (10) percent;
- (iv) A change in the geographic coordinates of a station's transmitting antenna of more than ~~five (5) seconds~~ of latitude or longitude, or both;

(v) Any change which increases the antenna height by ten (10) feet (_____ meters) or more;

(vi) Any technical change which would increase the effective radiated power in any direction by more than one and one-half (1.5) dB; or

(vii) Any changes or combination of changes which would cause harmful electrical interference to an authorized facility or result in a mutually exclusive conflict with another pending application;

(3) [Reserved]

(4) If the amendment would convert a proposal, such that it may have a significant impact upon the environment under § 1.1307 of the Commission's rules, which would require the submission of an environmental assessment, see § 1.1311 of this chapter, and Commission environmental review; see §§ 1.1308 and 1.1312 of this chapter.

(5) If the amendment results in a substantial and material alteration of the proposed service.

(6) If the amendment specifies a substantial change in beneficial ownership or control (*de jure* or *de facto*) of an applicant such that the change would require, in the case of an authorized station, the filing of a prior assignment or transfer of control application under section 310(d) of the Communications Act of 1934 [47 U.S.C. 310(d)]. Such a change would not be considered major where the assignment or transfer of control is for legitimate business purposes other than the acquisition of applications.

(7) If the amendment, or the cumulative effect of the amendment, is determined by the Commission otherwise to be substantial pursuant to section 309 of the Communications Act of 1934.

(d) In the Point-to-Point Microwave Radio Service and Local Television Transmission Service, a pending application may be amended by a major amendment to reflect the relocation of a proposed station site and a new application will not be required if:

(1) The geographic coordinates of the new station site are within twenty (20) miles (_____ km) of the coordinates of the original site; and,

(2) The relocated station would serve essentially the same purpose in the system as originally proposed.

(e) The applicant must serve copies of any amendments or other written communications upon the following parties:

(1) Any applicant whose application appears on its face to be mutually exclusive with the application being amended, including those applicants originally served under [§§21.504 and 21.902]:

(2) Any applicant whose application has been found by the Commission, as published in a public notice, to be mutually exclusive within the application being amended; and

(3) Any party who has filed a petition to deny the application or other formal objection, when that petition or formal objection has not been resolved by the Commission.

(f) The Commission may waive the service requirements of paragraph (e) of this section and prescribe such alternative procedures as may be appropriate under the circumstances to protect petitioners' interests and to avoid undue delay in a proceeding, if an applicant submits a request for waiver which demonstrates that the service requirement is unreasonably burdensome. Requests for waiver shall be served on petitioners. Oppositions to the petition may be filed within five (5) days after the petition is filed and shall be served on the applicant. Replies to oppositions will not be entertained.

(g) Any amendment to an application shall be signed and shall be submitted in the same manner, and with the same number of copies, as was the original application. Amendments may be made in letter form if they comply in all other respects with the requirements of this chapter.

Section 101.____ MINOR MODIFICATION.

(a) Unless an applicant is notified to the contrary by the Commission, as of the twenty-first day following the date of public notice, any application that meets the requirements of paragraph (b) of this section and proposes only the change specified in paragraph (c) of this section shall be deemed to have been authorized by the Commission.

(b) An application may be considered under the procedures of this section only if:

(1) It is in the Point-to-Point Microwave Radio, Local Television Transmission, Digital Electronic Message or Multipoint Distribution Services;

(2) The cumulative effect of all such applications made within any 60 days period does not exceed the appropriate values prescribed by paragraph (c) of this section;

(3) The facilities to be modified are not located within 35 miles (____ km) of the Canadian or Mexican border;

(4) It is acceptable for filing, is consistent with all of the Commission's rules, and does not involve a waiver request;

(5) It specifically requests consideration pursuant to this section; and

(6) Frequency coordination procedures, as necessary, are complied with in accordance with [§21.100(d)] or, in the Multipoint Distribution and Digital Electronic Message Services, a copy of the application has been served on those who also were served under [§§21.902 and 21.504].

(c) The modifications that may be authorized under the procedures of this section are:

(1) Changes in a transmitter and existing transmitter operating characteristics, or protective configuration of transmitter, provided that:

(i) In all radio services other than Multipoint Distribution Service and Digital Electronic Message Service, any increase in transmitter output power is less than three dB over the previously authorized output power; and in Digital Electronic Message Service, any increase in transmitter output power is one and one-half dB or less over the previously authorized output power; and in the Multipoint Distribution Service, any increase in EIRP is one and one-half dB or less over the previously-authorized power value.

(ii) ~~The necessary bandwidth is not increased beyond the previously authorized bandwidth;~~

(2) Changes in the height of an antenna, provided that:

(i) In all radio services except Multipoint Distribution Service and Digital Electronic Service, any increase in antenna height is less than ten (10) feet (____ meters) above the previously authorized height;

(ii) In Multipoint Distribution Service and Digital Electronic Message Service, any increase in antenna height is less than ten (10) feet (____ meters) above the previously authorized height; and

(iii) The overall height of the antenna structure is not increased as a result of the antenna extending above the height of the previously authorized structure, except when the new height of the antenna structure is twenty feet (____ meters) or less (above ground or man-made structure, as appropriate) after the change is made.

(3) Change in the geographical coordinates of a transmit station, receive station or passive facility by ~~five (5) seconds~~ or less of latitude, longitude or both, provided that when notice to the FAA of proposed construction is required by Part 17 of the rules for antenna

structure at the previously authorized coordinates (or will be required at the new location) the applicant must comply with the provisions of [§21.15(d)].

(4) An increase in the number of Digital Termination user stations.

(d) Upon grant of an application under the procedure of this section and at such time that construction begins, the applicant must keep a complete copy of the application (including the filing date) with the station license if construction is commenced prior to the receipt of the authorization.

(e) Equipment in an authorized radio station may be replaced without prior authorization or notification if the replacement equipment is identical (i.e., same manufacturer and model number) with the replaced equipment.

(f) Licensees of fixed stations in the Point-to-Point Microwave Radio, Local Television Transmission, Digital Electronic Message, or Multipoint Distribution Services may make the facility changes listed in paragraph (g) of this section without obtaining prior Commission authorization, if:

(1) Frequency coordination procedures, as necessary, are complied with in accordance with [§21.100(d)] or, in the Multipoint Distribution and Digital Electronic Message Services, a copy of the notification described in paragraph (f)(3) is served on those who were served under [§§21.902 and 21.504], and

(2) The cumulative effect of all facility changes made within any 60 day period does not exceed the appropriate values prescribed by paragraph (g) of this section, and

(3) The Commission is notified of changes made to facilities by the submission of a completed FCC Form 494 within thirty days after the changes are made.

(g) Modifications that may be made without prior authorization under paragraph (f) of this section are:

- (1) Change or modification of a transmitter, when:
 - (i) The replacement or modified transmitter is type-accepted (or type-notified) for use under this Part and is installed without modification from the type-accepted (or type-notified) configuration;
 - (ii) The type of modulation is not changed;
 - (iii) The frequency stability is equal to or better than the previously authorized frequency stability; and
 - (iv) The necessary bandwidth and the output power do not exceed the previously authorized values.
- (2) Addition or deletion of a transmitter for protection without changing the authorized power output (e.g., hot standby transmitters);
- (3) Change to an antenna (other than any change involving a periscope antenna system), when:
 - (i) For the Point-to-Point Microwave Radio and Local Television Transmission Services, the new antenna conforms to the requirements of [§21.108] and has essentially the same or better radiation characteristics than the previously authorized antenna;
 - (ii) For the Multipoint Distribution Service and Digital Electronic Message Service, the new antenna conforms with [§21.906] and the gain of the new antenna does not exceed that of the previously authorized antenna by more than one dB in any direction.
- (4) Any technical changes that would decrease the effective radiated power.
- (5) Change to the height of an antenna, when:
 - (i) The new height (measured at the center-of-radiation) is within \pm five feet (_____ meters) of the previously authorized height; and

(ii) The overall height of the antenna structure is not increased as a result of the antenna extending above the height of the previously authorized structure, except when the new height of the antenna structure is twenty feet or less (_____ meters) (above ground or man-made structure, as appropriate) after the change is made.

(6) Decreases in the overall height of an antenna structure, provided that, when notice to the FAA of proposed construction was required by Part 17 of the rules for the antenna structure at the previously authorized height, the applicant must comply with the provisions of [§21.15(d)].

(7) Changes in the azimuth of the center of the main lobe of radiation of a point-to-point station's antenna by a maximum of one degree.

(8) Changes to the transmission line and other devices between the transmitter and the antenna when the effective radiated power of the station is not increased by more than one dB.

(h) Licensees may correct erroneous information on a license which does not involve a major change (i.e., a change that would be classified as a major amendment as defined by [§21.23]) without obtaining prior Commission approval by filing a completed FCC Form 494.

REASON FOR RULE:

TIA proposes using current Section 21.23 for major modifications and current Sections 21.41 and 21.42 for minor modifications. Part 21 guidelines are preferable to Part 94 guidelines because they provide operators a minimum level of flexibility, which is required for microwave systems to utilize spectrum efficiently.

TIA proposes certain highlighted specific changes to Sections 21.23, 21.41 and 21.42 so that the new Part 101 provisions for major and minor modifications would conform to standard industry practices:

- Major modification, Sections (c)(1)(v) and (vii) – TIA proposes that changes in geographic coordinates (more than 5 instead of 10 seconds) and antenna height (more than 10 instead of 20 feet) (_____ meters) should be considered "major" because they are of a magnitude that affects coordination.
- Minor modification, Section (c)(1)(ii) – TIA is uncertain about the purpose of this rule (current Section 21.41(c)(1)(ii)). However, if a user exceeds its authorized bandwidth, the potential for interference increases. Thus, TIA proposes this change to ensure that any operation beyond the previously authorized bandwidth would be subject to prior frequency coordination as a "major" change.

FREQUENCY TOLERANCE

PROPOSED RULE:

Section 101.____ FREQUENCY TOLERANCE.

Stations authorized under this part shall maintain the carrier frequency of each authorized transmitter to within the following percentage of the assigned frequency:

Frequency Band (MHz)	TOLERANCE AS A PERCENTAGE OF ASSIGNED FREQUENCY		
	All fixed and base stations	Mobile stations over 3 watts	Mobile stations 3 watts or less (11)
25 to 50	0.002	0.002	0.005
50 to 450	0.0005	0.0005	0.005
450 to 512	0.00025	0.0005	0.0005
512 to 932 (12)	0.0005	0.0005	0.0005
932.0 to 932.5	0.00015		
932.5 to 935.0 (12)	0.00025		
941 to 941.5	0.00015		
941.5 to 944.0	0.00025		
944.0 to 952.0	0.0005	0.0005	
952.0 to 960.0	(1) (5)		
960.0 to 1,000	0.0005	0.0005	0.0005
1,850 to 1,990	0.002		
2,110 to 2,200 (14)	0.001		
2,450 to 2,500 (11)	0.001		
2,500 to 2,690 (11)	(2)		
3,700 to 4,200 (11)	0.005	0.005	0.005
5,925 to 6,425 (11)	0.005	0.005	0.005

6,425 to 6,525 (11)	0.005	0.005	0.005
6,525 to 6,875	0.005	0.005	0.005
10,550 to 10,680 (11)(13)	0.005 (9)	0.005	0.005
10,700 to 11,700 (11)	0.005 (10)	0.005	0.005
12,200 to 17,700	0.005 (3) (4)	0.03	0.03
17,700 to 18,820	0.003 (8)		
18,820 to 18,920	0.001		
18,920 to 19,700	0.003 (8)		
21,200 to 23,600	0.03 (7)	0.03	0.03
31,000 to 31,300	0.03	0.03	0.03
31,000 to 40,000	0.03	0.03	0.03

- (1) Transmitters authorized prior to January 1, 1981, at remote sites as part of a central protection alarm system are permitted a tolerance of .002%. Such stations may continue to operate as licensed until January 1, 1991.
- (2) in accordance with the technical standards contained in [§94.95] when A5 emission is to be employed. Otherwise, the frequency tolerance shall be 0.0025%.
- (3) For exceptions see [§94.90].
- (4) For the 13,200 - 13,250 MHz band, the permissible frequency tolerance is 0.03.
- (5) To be specified in authorization.
- (6) For point-to-point systems, with a channel greater than or equal to 50 KHz bandwidth, .0005; for multiple address master stations, regardless of bandwidth, .00015; for multiple address remote stations with 12.5 KHz bandwidths, .00015; for multiple address remote stations with channels greater than 12.5 KHz bandwidth, .0005.
- (7) For exceptions see [§94.91].
- (8) Existing type accepted equipment with a frequency tolerance of $\pm 0.03\%$ may be marketed until December 1, 1988. Equipment installed and operated prior to December 1, 1988, may continue to operate after that date with a minimum frequency tolerance of $\pm 0.03\%$. However, the replacement of equipment requires that the $\pm 0.003\%$ tolerance be met.
- (9) Digital Termination System transmitters must maintain frequency tolerances to within 0.0003%.
- (10) For remote stations with 12.5 KHz bandwidth, the tolerance is ± 0.00015 .

- (11) Below 512 MHz transmitter plate power input to the final frequency stage, as specified in the Commission's Radio Equipment List. Above 512 MHz transmitter power output, as specified in the Commission's Radio Equipment List.
- (12) Beginning Aug. 9, 1975, this tolerance will govern the marketing of equipment pursuant to §§2.803 and 2.805 of this chapter and the issuance of all authorizations for new radio equipment. Until that date new equipment may be authorized with a frequency tolerance of .03% in the frequency range 2,200 to 10,500 MHz and .05% in the range 10,500 MHz to 12,200 MHz, and equipment so authorized may continue to be used for its life provided that it does not cause interference to the operation of any other licensee. Equipment authorized in the frequency range 2,450 to 10,500 MHz prior to June 23, 1969, at a tolerance of .05% may continue to be used until February 1, 1976, provided it does not cause interference to the operation of any other licensee.
- (13) Equipment authorized to be operated on frequencies between 890 and 940 MHz as of Oct. 15, 1956, shall be required to maintain a frequency tolerance with 0.03% subject to the condition that no harmful interference is caused to any other radio station.
- (14) See [§21.503] for the stability requirements for transmitters used in the Digital Electronic Message Service.
- (15) Beginning November 1, 1991, equipment authorized to be operated in the frequency bands 2150-2162 MHz and 2596-2644 MHz for use in the Multipoint Distribution Service shall maintain a frequency tolerance with ± 1 KHz of the assigned frequency.

REASON FOR RULE:

The frequency tolerances for the 3,700 - 4,200, 5,925 - 6,425 MHz, and 10,700 - 11,700 MHz bands are added to the table. The frequency tolerance for the 10,550 - 10,680 MHz band is changed to 0.005 percent for point-to-point systems and 0.0003 percent for point-to-multipoint systems, which is the same as the 10,700-11,700 MHz band. This change would allow radios to be designed that cover both bands. Corrections are made to some of the footnote numbers. These changes are made to conform to the new rules adopted in the Second Report and Order.

PATH LENGTH REQUIREMENTS

PROPOSED RULE:

Section 101.____(a) PATH LENGTH.

The distance between end points of a fixed link must equal or exceed the value set forth in the table below or the EIRP must be reduced in accordance with the equation set forth below.

Frequency Band (MHz)	Minimum path length (km)
Below 1,850	n/a
1,850 to 7,125	17
10,550 to 13,250	5
Above 17,700	n/a

(b) For paths shorter than those specified in the Table, the EIRP shall not exceed the value derived from the following equation:

$$\text{EIRP} = x - y \log (A/B), \text{ dBW}$$

Where:

EIRP = Equivalent isotropic radiated power in dBW.

A = Minimum path length from the Table for the frequency band in kilometers.

B= The actual path length in kilometers.

For systems that use digital modulation techniques, use a channel bandwidth greater than 10 MHz, and meet the loading requirements given in Section [21.122], x = the maximum allowable EIRP for the band given in Section [21.107(b)] and $y = 40$. For all other systems, $x = 30$ and $y = 20$.

Note: For transmitters using Automatic Transmit Power Control, the EIRP that corresponds to the maximum transmitter power must satisfy this requirement.

(c) Upon an appropriate technical showing, applicants and licensees unable to meet the minimum path length requirement may be granted an exception to these requirements.

Note: Links authorized prior to April 1, 1987, need not comply with this requirement.

(d) The EIRP applies only to active transmitters; it does not apply to passive repeaters or reflectors.

REASON FOR RULE:

With the Docket 92-9 modifications, text was added to the Commission's Rules to allow ATPC to be used to meet the EIRP limitation (based on path length) up to a 3 dB increase in EIRP. Because the accepted industry procedure is to license the maximum transmitter power for ATPC systems, this rule would force the Commission to determine whether a path used ATPC in order to find out if it complied with the EIRP limitation. This 3 dB allowance should be deleted to simplify the Commission's responsibility.

On the other hand, some in the industry would like to use ATPC to exceed the EIRP limitation in order to build more reliable paths. Instead of using ATPC for this purpose, the EIRP restriction should be reduced in certain cases. The wider the receiver bandwidth, the greater the noise that is allowed into the system, and therefore the higher the receiver threshold. For wide band systems, it is thus desirable to use higher EIRP to compensate for the increased threshold and maintain an adequate fade margin for high reliability. The proposed modification of the EIRP restriction is an attempt to allow increased EIRP for wideband radios. For channel bandwidths 10 MHz and less, the rule is unchanged. For channel bandwidths greater than 10 MHz, the rule allows increased EIRP, but reduces it more quickly with decreasing path length in order to still discourage building very short paths. Although the Commission would have a slightly more complicated rule to enforce, the key piece of information -- the channel bandwidth -- already appears on the application forms and presumably would appear on the Part 101 application as well. Because the proposed rule refers to the loading standards of Section 21.122, it only applies to digital systems. The rule could be expanded to allow increased EIRP on high capacity analog systems if text requiring a minimum loading for these systems (50 percent of capacity) is added.

ANTENNAS

PROPOSED RULE:

Section 101.____. ANTENNAS.

(a) Unless otherwise authorized upon specific request by the applicant, each station authorized under the rules of this part shall employ a directional antenna adjusted with the center of the major lobe of radiation in the horizontal plane directed toward the receiving station with which it communicates; *Provided, however,* Where a station communicates with more than one point, a multi- or omni-directional antenna may be authorized if necessary. New Periscope antenna systems will not, under ordinary circumstances, be authorized.

(b) Stations operating below 2,500 MHz (other than stations in the Multipoint Distribution Service) which are required to use directional antennas shall employ antennas meeting the standards indicated below. (Maximum beamwidth is for the major lobe of radiation at the half power points. Suppression is the minimum attenuation required for any secondary lobe signal and is referenced to the maximum signal in the main lobe.)

Frequency Range	Maximum beamwidth (degrees)	Suppression (dB)
Below 512 MHz	80	10
512 to 1000 MHz	20	13
1500 to 2500 MHz	12	13

(c) Fixed stations (other than temporary fixed stations, Multipoint Distribution Service stations, and Digital Termination Service nodal stations) operating at 2,500 MHz or higher shall employ transmitting and receiving antennas (excluding second receiving antennas for operations such as space diversity) meeting the appropriate performance Category A indicated below,

except that, in areas not subjected to frequency congestion, antennas meeting performance Category B may be used subject to the liabilities set forth in [§21.109(b)].

Antenna Standards

Minimum radiation suppression to angle in degrees
from centerline of main beam in decibels

Frequency (MHz)	Category	Maximum beam-width to 3 points (included) angle in degrees)	Minimum antenna gain (dbi)	5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
932.5 to 935	A	14.0	n/a		6	11	14	17	20	24
941.5 to 944	B	20.0	n/a			6	10	13	15	20
952 to 960 (8) (9)	A	14.0	n/a		6	11	14	17	20	24
	B	20.0	n/a			6	10	13	15	20
1,850 to 1,990	A	5.0	n/a	12	18	22	25	29	33	39
	B	8.0	n/a	5	18	20	20	25	28	36
3,700 to 4,200	A	n/a	36	23	29	33	36	42	55	55
	B	n/a	36	20	24	28	32	32	32	32
5,925 to 6,425 (5)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	21	25	29	32	35	39	45
5,925 to 6,425 (6)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
6,525 to 6,875 (5)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	21	25	29	32	35	39	45
6,525 to 6,875 (6)	A	1.5	n/a	26	29	32	34	38	41	49
	B	2.0	n/a	21	25	29	32	35	39	45

10,550 to 10,680 (4)	A	n/a	38	25	29	33	36	42	55	55
(5)	B	n/a	38	20	24	28	32	35	35	39
10,550 to 10,680 (6)	A	3.4	34	20	24	28	32	35	55	55
	B	3.4	34	20	24	28	32	35	35	39
10,565 to 10,615 (7)	n/a	360	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10,630 to 10,680 (7)	n/a	n/a	34	20	24	28	32	35	36	36
10,700 to 11,700 (5)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
17,700 to 18,820	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
18,920 to 19,700 (1)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
21,200 to 23,600 (10)	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
31,000 to 31,300 (2) (3)	n/a	4.0	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Above 31,300	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36

(1) Digital Termination User Station antennas in this band shall meet performance Standard B and have a minimum antenna gain of 34 dBi. The maximum beamwidth requirement does not apply to DTS User Stations. Digital Termination Nodal Stations need not comply with these standards.

(2) The minimum front-to-back ratio shall be 38 dBi.

(3) Mobile, except aeronautical mobile, stations need not comply with these standards.

(4) Except for such antennas between 140° and 180° authorized or pending on January 1, 1989, in the band 10,550 to 10,565 MHz for which minimum radiation to suppression to angle (in degrees) from centerline of main beam is 36 decibels.

(5) These antenna standards apply to all point-to-point stations authorized after June 1, 1997. Existing licensees and pending applicants on that date are grandfathered and need not comply with these standards.

(6) These antenna standards apply to all point-to-point stations authorized on or before June 1, 1997.

(7) These antenna standards apply only to Digital Termination User Stations licensed, in operation, or applied for prior to July 15, 1993.

(8) Except for frequencies listed in [§94.65(a)(1)], where omnidirectional antennas may be used.

(9) Antennas used at outlying stations as part of a central protection alarm system need conform to only the following 2 standards: (1) The minimum on-beam forward gain must be at least 10 dBi, and (2) the minimum front-to-back ratio must be at least 20 dB.

(10) Except as provided in [§94.91].

NOTE: Stations must employ an antenna that meets the performance standards for Category A, except that in areas not subject to frequency congestion, antennas meeting standards for Category B may be employed. Note, however, that the Commission may require the use of high performance antennas where interference problems can be resolved by the use of such antennas.

(1) Category A standards apply to all stations operating in areas where certain microwave frequency bands are congested, or where there is a predictable risk of interference to other stations. [FORMULA TO BE PROVIDED] Stations operating in other areas, where there is less risk of interference, may use Category B antennas, but may have to change to Category A (or better) standards if interference problems arise.

(2) The congested areas in which microwave stations must use Category A antennas are arranged according to different frequency bands: 952 - 960 MHz, 1850 - 1990 MHz, 2130 - 2150/2180 - 2200 MHz, 5925 - 6425 MHz (lower 6 GHz), 6525 - 6875 MHz (upper 6 GHz), 10550 - 10680 MHz, 10700 - 11700 MHz, and 12 GHz. Congested areas vary from band to band, depending on types of operation, though some areas are congested in more than one band.

(3) No congested areas have been identified for some microwave bands. The 2150 - 2160 MHz band was excluded because only omni-directional transmissions are authorized. The 2450 - 2500 MHz band is shared with mobile and radiolocation services and is not protected from interference from ISM devices, so frequency congestion is difficult to determine. For this reason, microwave stations operating in the 2450 - 2500 MHz band in any area may use Category B antennas unless specific interference problems arise.

(4) Stations operating in the 2500 - 2690 MHz band must comply with technical standards for stations in the Instructional Television Fixed Service in Part 74 of FCC rules.

(d) In cases where passive reflectors are employed in conjunction with transmitting antenna systems, the foregoing paragraphs of this section also shall be applicable thereto. However, in such instances, the center of the major lobe of radiation from the antenna normally shall be directed at the passive reflector, and the center of the major lobe of radiation from the passive reflector directed toward the receiving station with which it communicates.

(e) These limitations are necessary to minimize the probability of harmful interference to reception in the bands 5925 - 6875 MHz on board geostationary space stations in the fixed-satellite service (Part 25).

(1) 5925 to 6875 MHz. No directional transmitting antenna utilized by a fixed station operating in these bands shall be aimed within 2 degrees of the geostationary-satellite orbit, taking into account atmospheric refraction. However, exception may be made in unusual circumstances upon a showing that there is no reasonable alternative to the transmission path proposed. If there is no evidence that such exception would cause possible harmful interference to an authorized satellite system, said transmission path may be authorized on waiver basis where the maximum value of the equivalent isotropically radiated power (EIRP) does not exceed:

- (i) +47 dBW for any antenna beam directed within 0.5 degrees of the stationary satellite orbit; or
- (ii) +47 to +55 dBW, on a linear decibel scale (8 dB per degree) for any antenna beam directed between 0.5 degrees and 1.5 degrees of the stationary orbit.

(2) Methods for calculating the azimuths to be avoided may be found in: CCIR Report No. 393 (Green Books), New Delhi, 1970; in "Radio-Relay Antenna Pointing for Controlled Interference with Geostationary Satellites" by C. W. Lundgren and A.S. May, Bell System Technical Journal, Vol. 48, No. 10, pp. 3387 - 3422, December 1969; and in "Geostationary Orbit Avoidance Computer Program" by Richard G. Gould, Common Carrier Bureau Report, CC-7201, FCC, Washington, D.C., 1972. This latter report is available through the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22151, in printed form (PB-211 500) or source card deck (PB-211 501).

REASON FOR RULE:

TIA proposes use of Section 21.108 to govern operation of antennas under Part 101. However, TIA recommends that Section 21.108 be modified to: (1) change the Category B standards for the upper 6 GHz band; (2) incorporate and update the Commission's 1983 Public Notice regarding use of Category A antennas in "congested" areas; and (3) provide for cross-polarization.

Upper 6 GHz Band Category B Standards – In the 6 GHz band (5925-6425 and 6525-6875), the Commission has imposed new Category A and B standards to become effective June 1, 1997. The new standards appear to be a consolidation of the existing antenna standards found in Parts 21 and 94. The Category A standards, which apply after June 1, 1997, are identical for the lower and upper 6 GHz bands. However, for Category B antennas, there is a lessening of the radiation suppression requirements in 1997 for the upper 6 GHz band and an increase in requirements for the lower 6 GHz band (see figures 1 through 4). Following the logic applied to the Category A standards, the Commission should impose the more stringent upper 6 GHz band Category B standards across the entire 6 GHz band. Thus, it appears that the discrimination values for Category B in the upper 6 GHz band after June 1, 1997, should be 39

and 45 dB for 100° to 140° and 140° to 180°, respectively. The Commission correctly concludes that the antenna standards need further study and industry groups, such as the NSMA and TIA, will be working to formulate new requirements.

"Congested areas" – In 1983, the Commission re-issued its 1979 Public Notice requiring use of Category A antennas in "congested" areas. To ensure that this requirement is followed, TIA proposes that it be included in the rules. However, given rapid marketplace changes, TIA proposes that a formula be adopted to define a "congested" area and that the Commission periodically issue a Public Notice listing then current "congested areas."

Cross-Polarization – The new Part 101 rules should not preclude the uses of microwave radio systems that increase bandwidth capacity by using cross-polarization (i.e., both polarizations – site and frequency – are used at the same time). Permitting use of cross-polarization would result in increased spectrum efficiency by making more bandwidth available. Thus, the Commission must not incorporate any rule provisions that prohibit cross-polarization.